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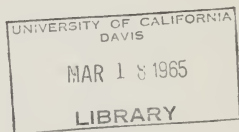


State of California  
THE RESOURCES AGENCY  
Department of Water Resources

BULLETIN No. 119-13

FEASIBILITY OF SERVING  
THE DEVIL'S DEN WATER DISTRICT  
FROM THE STATE WATER PROJECT

FEBRUARY 1965



HUGO FISHER  
*Administrator*  
The Resources Agency

EDMUND G. BROWN  
*Governor*  
State of California

WILLIAM E. WARNE  
*Director*  
Department of Water Resources



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## FOREWORD

In November 1960, the California Water Resources Development Bond Act was approved by the State's electorate, paving the way for the construction of the State Water Project as the first phase of the California Water Plan. Since that time, many local water service agencies throughout the State have contracted with the State for water service from the proposed facilities. Several water agencies have been organized since November 1960 expressly for the purpose of obtaining water supplies from the state facilities for the areas they represent.

Prior to executing water supply contracts with water agencies, the Department of Water Resources makes studies of the agencies and the areas encompassed by them to determine the propriety of entering into such contracts. These studies are made with the goal of evaluating (1) each area's future demand for supplemental water supplies, (2) the legal ability of each agency in question to enter into a water supply contract with the State, (3) the engineering feasibility of providing the proposed water service, and (4) the financial ability of the agency to contract for a water supply from the State Water Project.

The results of the studies made for each agency, as described above, along with significant supporting material, are embodied in reports published by the Department of Water Resources. This bulletin is one of a series of such publications and describes studies which led to the signing of a

contract with the Devil's Den Water District on December 20, 1963. The contract provides for the delivery of a maximum annual entitlement of 11,000 acre-feet of water from the California Aqueduct.

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3	Water Cost-Demand Curve for Devil's Den Water District

State of California  
The Resources Agency  
Department of Water Resources

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Engineer





## CHAPTER I. INTRODUCTION

In July 1961, proponents of the Devil's Den Water District indicated their intention to form that district and negotiate a contract with the Department of Water Resources for a water supply from the State Water Project. Subsequently the district was formed in December 1962, and a contract between the State and the district was executed on December 20, 1963. Presented in this report are data which demonstrate the need for and feasibility of the contract for a maximum annual entitlement of 11,000 acre-feet of water from the Coastal Aqueduct which includes an option to contract for a share of the project yield uncontracted on December 31, 1963.

This chapter describes the district's history, economy, powers, and service area. Also included is a statement concerning the water supply available to the San Joaquin Valley from the State Water Project. In the following chapters there are presented discussions of the potential water demand, the cost of water service from the State Water Project, and demand for project water considering the possible limiting effect of the cost of water. The report concludes with an analysis of the financial feasibility of the district's purchasing water from the State.

In the course of negotiations with the district, the department's office report "Supplement to Information and Data on Proposed Program for Financing and Constructing State Water Facilities" dated May 1960 and the department's Bulletin No. 3, "The California Water Plan," were available for consideration.

These reports, along with the prototype water supply contract between the State and The Metropolitan Water District of Southern California, the "Standard Provisions for Water Supply Contract" approved August 3, 1962, and Bulletin No. 132-63, "The California State Water Project in 1963," provided the bases for negotiation.

During 1962 and 1963, several meetings were held with the directors and the engineer of the district. Several studies were made and presented by the department to show charges which would be made by the State to the district for water under several assumptions as to maximum annual entitlement and buildup of demand.

#### The Devil's Den Water District

The Devil's Den Water District was formed in accordance with the provisions of the California Water District Law. The formation of the district was approved by the voters November 27, 1962, and the Kings County Board of Supervisors declared the district formed on December 10, 1962. The district includes land in Kings and Kern Counties.

The district was organized primarily for the purpose of contracting with the State for a water supply to supplement the existing ground water supply in the Devil's Den area. The district's contract with the State includes a special provision to assign 6,200 acre-feet of the maximum annual entitlement to the Kern County Water Agency for use on the land in the district which lies within Kern County.

The California Water District Law is contained in Division 13, Sections 34000 through 38501, of the California Water Code. The code describes district powers and duties and prescribes the procedures for district formation, organization, management, and financing.

#### Powers of the District

General. The district may acquire, construct, and operate works necessary to provide water and related drainage and reclamation (Section 35401), and also works for sewage disposal (Section 35500). Portions of the territory within the district may be formed into improvement districts (Sections 36410, 36450) or distribution districts (Section 36460) to bear the costs of certain works benefiting only those areas. Only landowners may vote in district elections (Section 34027), on the basis of one vote for each dollar of assessed valuation (Section 35003).

Contracts. The district may enter into such contracts as are necessary to carry out the purposes of the district (Section 35406). The district is given specific authority to contract with the State for the purpose of developing water supplies (Section 35851). Contracts entered into pursuant to Section 35851 must be approved by the California Districts Securities Commission (Section 35854). The district is also empowered to contract for water from the State Water Project

by provisions of the Central Valley Project Act (see Water Code Sections 11102, 11625, 11661, and 11662).

Fiscal Powers. The district may obtain funds by water charges (Section 35470) and by ad valorem assessment of land, exclusive of improvements and mineral, oil, and gas rights (Section 36550 et seq., Section 37200 et seq.). Subject to varying restrictions, funds may be raised within an improvement district by water charges (Sections 36451, 23800 et seq.), assessment according to benefits (Sections 36451, 23626), or ad valorem assessment (Sections 36452, 23532); and within a distribution district by water charges (Section 36522) or by assessment according to benefits (Section 36471). The district may issue both general obligation and revenue bonds (Section 35950 et seq.). The issuance of general obligation bonds must be approved by a two-thirds vote and revenue bonds by a majority vote (Section 35155). The district may incur a short-term debt (by issuing warrants payable at a future time) without holding an election (Section 36400). General obligation bonds (Section 36151) and warrants (Section 36408) must be authorized by the California Districts Securities Commission. General obligation bonds (Sections 36423, 36451, 23913) or warrants (Sections 36451, 23975) of the district for an improvement district may also be issued.

#### The District's Service Area

The Devil's Den Water District is located in Kings and Kern Counties as shown on Plate 1, "Location of Devil's

Den Water District." The district, as is shown on Plate 2, "Devil's Den Water District," comprises 8,693 acres, of which 5,075 acres are in Kern County and 3,618 acres are in Kings County. The irrigated land in the district has numerous owners, but it is at present farmed by one organization. Irrigable land in the district is smooth and lies at elevations ranging from about 420 feet at the north boundary of the district to about 550 feet adjacent to hills bordering the district at several locations. Plans of the district are to serve the area east of the west line of Section 1, Township 25 South, Range 18 East. This service area comprises 7,160 acres.

The economy in Devil's Den Water District is closely associated with irrigated agriculture. Most, if not all, of the wage earners living in the district work directly in agriculture or at jobs related to agriculture. It is believed that the population, which numbers fewer than 100 persons at present, will increase to some extent as the district approaches full agricultural development, but the increase will not significantly affect the district's water requirement.

According to a detailed land use survey made by the department in 1958, there were 2,900 acres of irrigated land in the district, of which 1,940 acres were devoted to cotton and 960 acres to grain. Present development is approximately the same as in 1958 and is limited by a ground water supply of poor quality and inadequate quantity. Crop selection is restricted to those crops which have a relatively high salt tolerance.

The climate, based on nearby climatological stations, is characterized by low humidity, low annual rainfall, cool winters, and hot summers. Annual precipitation averages 6.5 inches, of which most occurs from November through March. Temperatures range from an average daily maximum of about 98° Fahrenheit in the month of July to an average daily minimum of about 36° Fahrenheit in January.

Water Supply Available to San Joaquin Valley  
From the State Water Project

The California Water Commission has assigned certain state applications for appropriation of water to the department for the operation of the State Water Project. The applications show that as of December 1963 the water appropriated would be used in the following service areas:

<u>Area</u>	<u>Amount in Acre-feet</u>
Feather River	210,000
North Bay	181,000
South Bay	210,000
San Joaquin Valley	1,547,000 <sup>1/</sup>
Central Coastal	85,000
Southern California	<u>1,917,000</u>
Total	4,150,000

---

<sup>1/</sup> Includes 36,000 acre-feet reserved for San Joaquin Valley but not to be transferred from South Bay and Central Coastal allocations until needed, and 36,000 acre-feet transferred from North Bay and Feather River allocations to an unallocated pool held in reserve for San Joaquin Valley when and if needed and for any other area of the State if not required in the San Joaquin Valley.

Although the above tabulation shows 4,150,000 acre-feet of water would be diverted for use in the indicated service areas, the prototype contract states that the contracted maximum annual entitlement may not in the aggregate exceed 4,000,000 acre-feet or the minimum project yield, whichever is the lesser. The term "minimum project yield" is defined in Article 1(k) of the "Standard Provisions for Water Supply Contract" and is now estimated to be 4,000,000 acre-feet.

As of mid-December 1963, when the water supply contract between the State and the Devil's Den Water District was in the final negotiation stage, the only San Joaquin Valley contract which had been consummated was that with Kern County Water Agency for 1,000,000 acre-feet. Other San Joaquin Valley contracts under consideration totaled about 206,500 acre-feet. Thus ample water for annual entitlements was available for contracting with the district.

In addition to annual entitlements under water supply contracts, surplus water will be available from the project. The amounts of surplus water assumed to be delivered to the district on an irrigation demand schedule are shown in column 3 of Table 6, "Financial Analysis, Devil's Den Water District" (bound at the end of the report).





## CHAPTER II. POTENTIAL WATER DEMAND

Presented in this chapter are discussions of the factors affecting agricultural water demand and an estimate of the potential water demand in the Devil's Den Water District based on a consideration of classification of land, unit water use, and market outlook, but disregarding the cost and availability of water. The latter are considered in Chapters III and IV.

Presented first are land classification data, estimates of unit use of applied water, and a discussion of market outlook. These are followed by a determination of the potential requirement for water and an analysis of the present water supply.

The urban water requirement has been omitted because of its relative insignificance since the present population in the district is small and its future growth will be nominal. The chapter concludes with a determination of the potential requirement for imported water calculated as the difference between the total potential requirement and the present ground water supply.

### Agricultural Water Demand Factors <sup>1/</sup>

#### Classification of Land

A land classification survey was conducted in the San Joaquin Valley by the Department of Water Resources during the

1/ For additional information see "Appendix to Final Report, General Evaluation of the Proposed Program for Financing and Constructing the State Water Resources Development System of the State of California, Department of Water Resources," October 1960, by Charles T. Main, Inc.

period 1956-61. Table 1, "Classification of Irrigable Land in Devil's Den Water District Service Area," is based on data obtained from that survey. The areas shown are net values after reducing the gross service area, consisting of 7,160 acres, to allow for land occupied by farm lots, highways, canals, etc.

TABLE 1  
CLASSIFICATION OF IRRIGABLE LAND IN  
DEVIL'S DEN WATER DISTRICT SERVICE AREA  
(In net acres)<sup>1/</sup>

Valley Land of Excellent Quality <sup>2/</sup>	Valley Land of Medium Quality <sup>3/</sup>	Valley Land of Poor Quality <sup>4/</sup>	Sloping Land <sup>5/</sup>	Total
5,780	260	40	390	6,470

- 
- <sup>1/</sup> After allowance for farm lots, highways, canals, etc.  
<sup>2/</sup> Land classified as V and Vs.  
<sup>3/</sup> Land classified as Vl, Vp, Vh, Vls and Vhs.  
<sup>4/</sup> Land classified as Vsa, Vpss and Vpsa.  
<sup>5/</sup> Land classified as H and M.

Note: For definitions of land classification symbols see the Department of Water Resources' "Report on Proposed Belridge Water Storage District, Kern County," December 1961.

#### Unit Use of Applied Agricultural Water

Estimated values of unit use of applied water for crops projected in the district are tabulated in Table 2, "Unit Use Values of Applied Water for Crops Projected in Devil's Den Water District Service Area."

TABLE 2

UNIT USE VALUES OF APPLIED WATER FOR  
CROPS PROJECTED IN DEVIL'S DEN WATER DISTRICT SERVICE AREA

Crop	:	Acre-feet of Water
	:	Per Acre of
	:	Irrigated Land
<u>Major Irrigation Season</u>		
Alfalfa, seed		3.2
Miscellaneous truck		2.4
Cotton		3.8
Deciduous fruit and nuts		2.9
Miscellaneous field		2.1
Sugar beets		2.9
Grapes		3.1
<u>Minor Irrigation Season</u>		
Miscellaneous truck		2.4
Grain		1.1

Market Outlook

In an office study prepared in 1958 entitled "Market Outlook for Selected California Crops, 1960-2020," the department estimated future demand for specialty farm products grown in California. That study was used as a guide, together with other criteria, in estimating the district's share of the total California 1990 market for specialty farm crops. This determination took into consideration the historical shifts in the production of crops among different producing areas in California. The historical regional crop production shifts for the past 40 years were plotted and projected to the year 1990.

### Tentative Crop Pattern

From the market outlook study for specialty crops and estimated values of 1990 crop yields, the acreage necessary to supply the market demand for specialty crops in the district was determined. A tentative crop pattern was prepared for this acreage and the remaining acreage of the district on which non-specialty crops would be grown.

The 1990 projected crop pattern in the district is shown in Table 3, "Tentative Crop Pattern in Devil's Den Water District Service Area in 1990 Based on Consideration of Land Classification and Market Outlook."

TABLE 3

**TENTATIVE CROP PATTERN**  
**IN DEVIL'S DEN WATER DISTRICT SERVICE AREA IN 1990**  
**BASED ON CONSIDERATION OF LAND CLASSIFICATION AND MARKET OUTLOOK**  
**(In net acres)**

Crop	: Acres
<u>Major Irrigation Season</u>	
Deciduous fruit and nuts	500
Grapes	150
Cotton	1,800
Miscellaneous truck	700
Sugar beets	500
Miscellaneous field	1,470
Alfalfa, seed	750
Fallow	600
<u>Minor Irrigation Season</u>	
Miscellaneous truck	(400)
Grain	(1,200)
Total	6,470

Note: Amounts in parentheses indicate double cropped acreage. Such acreage is included only once in the total.

### Potential Water Requirement

It is estimated that there is a potential water requirement of about 19,650 acre-feet in the Devil's Den Water District service area. This amount is the sum of the products of the crop acreages in Table 3 and the appropriate unit use values of applied water in Table 2. The determination of this quantity is based on consideration of the previously described agricultural water demand factors, but disregards the economic factor of water cost and the availability of water.

### Present Water Supply

#### Safe Yield of Local Supply

There is no presently developed surface water supply in the district, and the potential safe yield from surface sources is negligible. Streamflow in the area is intermittent, and when it does occur it is usually of short duration.

Ground water provides the entire presently developed water supply in the district, but ground water extractions unquestionably exceed the safe yield. Safe ground water yield is defined as that amount of water which can be withdrawn from the underground supply for an indefinite period without causing harmful results to ground water levels or quality. The water levels in wells in the district are dropping steadily showing that the replenishment of the ground water supply is not keeping up with the withdrawals. Furthermore, the levels are reaching undesirable depths, and water quality is becoming poorer as the levels recede. It is estimated that the safe yield of

the local ground water supply in the service area is approximately 4,200<sup>2/</sup> acre-feet at the present time.

It is further estimated that under conditions of full development, 6,400 acre-feet of water per year could be safely pumped from the ground water supply including both safe local yield and reuse of percolate from the future imported supply.

#### Potential Requirement for Imported Water

Under full development, 13,250 acre-feet per year of supplemental imported water will be required in addition to future yield of local ground water in the amount of 6,400 acre-feet to satisfy the 19,650 acre-foot potential water requirement of the district's service area.

<sup>2/</sup> From Stoddard and Karrer, consulting engineers for Devil's Den Water District.

### CHAPTER III. COST OF WATER SERVICE FROM THE STATE WATER PROJECT

The cost to water users in the Devil's Den Water District for water service from the State Water Project is dependent upon the allocation to the district of its share of the costs of the project facilities for conservation and transportation plus the cost for local distribution of water. The State Water Project will be constructed by the State primarily with funds provided under terms of the California Water Resources Development Bond Act.<sup>1/</sup> There are in existence distribution facilities sufficient to distribute the local and imported water supply to the district's service area. These facilities are owned and operated by the organization presently farming land in the district. It is not known who will own and operate these facilities in the future, but in this report it is assumed that the district will distribute the water, incur all operation and maintenance costs, and collect therefor from the water users.

Allocation of project costs to the district is governed by the contract executed on November 4, 1960, between the State and The Metropolitan Water District of Southern California. This contract is the department's prototype water supply contract. The department's publication "Standard Provisions for Water Supply Contract" approved August 3, 1962, is based on the prototype contract.

The standard provisions set forth the terms which will be generally applicable to all contracts, and establish the mutual

<sup>1/</sup> Chapter 8 (Commencing with Section 12930) of Part 6 of Division 6 of the Water Code.

obligations of the State and the water supply contractors. The State's essential obligation is to make available for delivery to the contracting agency, at its delivery structures, designated amounts of project water each year, commencing with the year of initial water delivery and continuing through the life of the contract. The essential obligation of the contracting agency is to make all payments required under the contract.

#### Cost of State Water

Under terms of the department's water supply contracts, each contracting agency will be charged for such quantities of project water as it is entitled to receive each year. In addition, charges will be made for surplus water which will be available to each agency under certain conditions.

#### Cost of Entitlement Water

Charges under the contracts are made to secure payment of reimbursable costs of the project conservation works and project transportation facilities necessary to deliver water. Charges for these purposes are called, respectively, the Delta Water Charge and the Transportation Charge.

Delta Water Charge. Every contractor for project water will pay the Delta Water Charge as an annual charge per acre-foot of the contractor's annual entitlement for each year. This charge, together with revenues derived from power generated in connection with the operation of project conservation facilities, will return to the State all reimbursable costs of the conservation facilities over the project repayment period.



The Delta Water Charge is established at a rate of \$3.50 per acre-foot through the year 1969 and is estimated to be \$5.46 per acre-foot for the period 1970 through 1977, and \$7.34 per acre-foot thereafter until supplemental conservation facilities, as defined in the standard provisions, are constructed. Estimated charges for this component for the demand buildup described in Chapter IV are included in Table 4, "Summary of Annual Charges to Devil's Den Water District for Water from the State Water Project."

Transportation Charge. In addition to the Delta Water Charge, contractors receiving water from the State Water Project will pay for the construction and operation of the transportation facilities. Articles 23 through 28 of the standard provisions govern the determination of the transportation charge.

The allocation of the costs to each contractor of construction and operation of the transportation facilities is made on a proportionate-use-of-facilities basis. The construction cost and the minimum or fixed operation, maintenance, power, and replacement costs are allocated on the basis of the maximum annual entitlement and peaking capacity provided for the contractor within each reach of the aqueduct which would be used to convey water to the contractor. The variable operation, maintenance, power, and replacement costs are allocated on the basis of the contractor's share of water delivered through each reach of the aqueduct during each year.

The project transportation facilities that would be used to provide water to the Devil's Den Water District are the

TABLE 4

SUMMARY OF ANNUAL CHARGES TO DEVIL'S DEN WATER DISTRICT  
FOR WATER FROM THE STATE WATER PROJECT  
(In dollars unless otherwise noted)

Calendar Year	ANNUAL ENTITLEMENTS (In acre-feet)	ALLOCATED TRANS- PORTATION CAPITAL COSTS	Capital Cost Component	TRANSPORTATION CHARGES				Total Trans- portation Charge	DELTA WATER CHARGE	TOTAL WATER CHARGES
				Minimum Component	Variable Component	OMP & R Component	Variable Component			
1964	0	318,600	0	0	0	0	0	0	0	100
1965	0	236,400	0	0	0	0	0	100	0	100
1966	0	358,100	0	100	0	0	0	37,700	7,000	44,700
1967	0	208,900	0	1,100	0	0	19,400	37,000	10,500	47,500
1968	2,000	47,800	12,400	5,900	19,400	25,900	54,300	64,300	21,800	86,100
1969	3,000	11,400	18,700	10,000	13,000	25,900	64,300	80,900	27,300	108,200
1970	4,000	21,400	24,900	13,000	15,500	33,200	97,700	110,000	38,200	148,200
1971	5,000	31,100	31,100	15,500	19,300	41,100	122,900	138,800	43,700	182,500
1972	6,000	27,000	37,300	19,300	19,300	47,200	152,500	165,800	60,100	225,900
1973	7,000	5,500	43,500	19,300	19,300	53,800	165,800	189,500	80,700	270,200
1974	8,000	8,000	49,800	19,300	19,300	53,800	165,800	189,500	80,700	270,200
1975	8,000	8,900	56,000	19,300	19,300	53,800	165,800	189,500	80,700	270,200
1976	10,000	8,100	62,200	19,300	19,300	53,800	165,800	189,500	80,700	270,200
1977	11,000	10,100	68,400	19,300	19,300	53,800	165,800	189,500	80,700	270,200
1978	11,000	10,800	68,400	19,300	19,300	53,800	165,800	189,500	80,700	270,200
1979	11,000	5,700	68,400	19,300	19,300	53,800	165,800	189,500	80,700	270,200
1980	11,000	3,000	68,400	16,200	16,200	74,200	158,800	175,000	80,700	255,700
1981	11,000	3,000	68,400	16,200	16,200	74,200	158,800	175,000	80,700	255,700
1982	11,000	1,800	68,400	16,200	16,200	74,200	158,800	175,000	80,700	255,700
1983	11,000	2,300	68,400	16,200	16,200	74,200	158,800	175,000	80,700	255,700
1984	11,000	2,400	68,400	16,200	16,200	74,200	158,800	175,000	80,700	255,700
1985	11,000	700	68,400	16,200	16,200	74,200	158,800	175,000	80,700	255,700
1986	11,000	0	68,400	16,200	16,200	74,200	158,800	175,000	80,700	255,700
1987	11,000	0	68,400	16,200	16,200	74,200	158,800	175,000	80,700	255,700
1988	11,000	0	68,400	16,200	16,200	74,200	158,800	175,000	80,700	255,700
1989	11,000	0	68,400	16,200	16,200	74,200	158,800	175,000	80,700	255,700
1990	11,000	0	68,400	16,200	16,200	74,200	158,800	175,000	80,700	255,700
1991-2035	11,000	0	68,400	16,200	16,200	74,200	158,800	175,000	80,700	255,700
TOTALS	703,000	1,306,900	4,371,500	1,108,300	4,176,400	9,655,000	5,025,700	14,681,900	6.86	21.08
EQUIVALENT UNIT RATES (in dollars per acre-foot)			6.22	1.74	6.26	14.22				

portions of the California Aqueduct from the Sacramento-San Joaquin Delta to the junction with the Coastal Aqueduct near Avenal Gap, and the Coastal Aqueduct from this point to the district. The tentative design of the Coastal Aqueduct indicates that water will flow from the California Aqueduct at an elevation of about 310 feet to the Las Perillas Pumping Plant, which will lift the water to an elevation of about 365 feet, and to the Avenal Pumping Plant, which will lift the water to an elevation of about 517 feet. From this pumping plant the water will flow by gravity through approximately nine miles of canal to a point about six miles south of the boundary line between Kings and Kern Counties, where it will terminate until extended to serve the central coastal counties.

The total transportation capital cost allocated to the district is estimated to be \$1,306,900 for a maximum annual entitlement of 11,000 acre-feet at a maximum monthly peaking rate of 18 percent.

Under Article 24(c) of the standard provisions, the construction or capital cost component of the transportation charge allocated each year to a contractor must be paid in 50 equal annual payments of principal and interest. Article 45 of the prototype contract, however, permits modification of such payment method within certain limitations. Payment at a unit rate per acre-foot of water delivered which will repay all costs with interest during the project repayment period is such a permissible modification and is the method of payment assumed herein. The unit rate is estimated to be \$6.22 per acre-foot.

Payment at this rate commencing in the initial year of water delivery will repay all principal, together with interest at the project interest rate compounded annually, of capital cost allocated to agricultural use within the project repayment period.

Estimated annual values for the Delta Water Charge and the components of the Transportation Charge for deliveries to the district are shown in Table 4.

The determination of charges under the contract, as described above and as summarized in Table 4, does not result in a uniform charge per acre-foot of entitlement water throughout the repayment period. However, since major portions of the total charge are on a unit rate basis, the total charge is fairly uniform. Equivalent unit rates have been computed for the purposes of comparison of components of the total charge for delivering to the district the entitlements of water shown in Table 4. The equivalent unit rate is defined as that constant charge which when assessed against each acre-foot of delivery during the entire repayment period will produce a sum by the end of the period equivalent to the annual charges which would have been assessed under a water supply contract, together with interest computed at the project interest rate which is assumed to be four percent per annum. The total estimated equivalent unit rate for service of annual entitlements to the district under these assumptions is \$21.08 per acre-foot at canalside, as shown in Table 4.

#### Cost of Surplus Water

Article 21 of the standard provisions provides that if during any year the supply of project water, after appropriate

allowance for holdover storage, exceeds the total of annual entitlements of all contractors for that year, the State shall offer to sell and deliver such surplus water for periods expiring not later than the end of such year. The article also provides that the charge for surplus water shall be at least equal to the variable operation, maintenance, and power costs incurred in service for such water. This would include variable charges for both the conservation and transportation facilities.

Under a modification of Article 21 in the contract negotiated with the district, surplus water would be allocable to the district for agricultural and ground water replenishment use on the basis of the amount of entitlement water it so uses.<sup>2/</sup> Such surplus water would be furnished at prices which would return to the State the variable operation, maintenance, power, and replacement components of the Delta Water Charge and Transportation Charge incurred in the delivery of such water. Contracts made pursuant to such modification of Article 21 may exceed one year in duration.

The unit rate for surplus water which could be supplied for agricultural and ground water replenishment use in the district is estimated to range from \$7 to \$8 per acre-foot. It is estimated that surplus water will be available to the district on an irrigation demand schedule through 1981.

The equivalent unit rate for delivery of combined project water to meet annual entitlements and surplus water is about \$19.60

<sup>2/</sup> Article 45(a) of contract between Devil's Den Water District and State dated December 20, 1963.

per acre-foot over the repayment period for the contracted annual entitlements shown in column 2 and the assumed deliveries of surplus water shown in column 3 of Table 6.

### Surcharge

A surcharge representing the power credit per acre-foot of water will be made for project water put to agricultural or manufacturing use on excess land. This surcharge is provided for in Article 30 of the standard contract provisions, and is established as \$2 per acre-foot until all of the facilities for generation of electrical energy in connection with the operation of initial project conservation facilities are installed and in operation. Each year thereafter the State will redetermine the power credit per acre-foot of water. Excess land is defined as that part of any land in excess of 160 acres in single beneficial ownership, or 320 acres in joint ownership by husband and wife. The surcharge would be applicable to project water delivered under the district's annual entitlements and to surplus water.

### Surcharge Credit

Under terms of San Joaquin Valley agricultural contracts, the State may allow a credit to the contractor not to exceed the surcharge to be paid by such contractor, which credit shall be utilized to reduce the cost of water for agricultural use on other than excess land at a uniform rate not to exceed \$2 per acre-foot.<sup>3/</sup>

<sup>3/</sup> Article 45(b) of the contract between Devil's Den Water District and the State dated December 20, 1963.

### Local Distribution System

The Devil's Den Water District is favorably located to receive imported state water as most of the district's land lies below the Coastal Aqueduct, which will traverse the district at an elevation of about 510 feet. In addition, the existing distribution system can deliver irrigation water to the irrigable portion (6,470 acres) of the service area. For this reason the capital cost for conveying water from the Coastal Aqueduct to district land is essentially that necessary for a turnout structure. This cost is estimated to be about \$20,000 which must be paid in advance. In addition, it is estimated there will be annual costs of \$1.33 per acre-foot during the project repayment period for operation, maintenance, administration, and replacement costs of the distribution system serving the district's service area.





## CHAPTER IV. DEMAND FOR PROJECT WATER

Presented in this chapter are the relevant economic factors and data used to determine project water demand, an estimate of the demand, and a determination of the buildup of demand in the Devil's Den Water District. The purpose of studying these matters was to determine to what extent the farming of land in the district could support the purchase of the "potential requirement for imported water" which was developed in Chapter II.

### Payment Capacity of Crops

In this report, payment capacity is defined as the amount which is available from gross crop revenues to pay water costs after deducting all other farm production expenses. The appraisal of crop payment capacity per acre-foot of water involves the consideration of crop yields, prices received, crop production costs, and other factors related thereto. These factors are discussed, and a payment capacity determination is presented, in the following paragraphs.

### Crop Yields

Crop yields used in this payment capacity analysis were developed following review of Kings County and Kern County agriculture reports and conferences with local authorities. The yields are projected at a conservative level and are considered attainable by the bulk of the farm operators in the southern San Joaquin Valley.

### Prices Received

The prices of farm products used in this analysis are essentially the averages of prices received by Devil's Den farmers during the 1952-56 period. This information was obtained from the Agriculture Commissioner's reports and conferences with local authorities.

### Crop Production Costs

Crop production costs are computed on a per acre basis, using the estimated average unit prices paid during the 1952-56 period for the factors of production, including interest, taxes, and wages. These unit prices are applied to all labor and materials, except water, used in production; cash overhead, such as taxes, repairs, and general expenses; depreciation and all interest charges except those related to land development; and management charges.

In addition to the foregoing, there is included in the crop production costs an allowance for occasional losses attributable to inclement weather and adverse market conditions. This allowance also provides for the slightly increased farming cost associated with share or cash rental arrangements as compared with the cost of owner-operation.

### Drainage

The ground water in the Devil's Den Water District occurs primarily in alluvial fans which are moderately permeable and essentially have free subsurface drainage.

### Payment Capacity Determination

Estimated crop production costs on a per-acre basis,

excluding cost of water, for each of the projected crops shown in Table 3, were deducted from the gross income values, derived from crop yields and prices received, to establish the payment capacity per acre of each crop. Payment capacities at the farm headgate for the projected crops are shown in Table 5, "Estimated Annual Payment Capacities and Water Demand Schedule for Devil's Den Water District Service Area."

#### Economic Demand for Water

In this report a water demand schedule is defined as a catalogue of quantities of water that will be purchased at various possible prices at a given time. Such a schedule indicates the relationship of demand for water to cost of water and is presented here in tabular form and as a water cost-demand curve.

A water demand schedule is based on the principle that as the price of water decreases the demand for water increases and, conversely, as the price increases the demand decreases. This difference in the demand occurs because different crops possess different abilities to pay for water, different lands have different abilities to grow crops, and operators with sunk investments and receding ground water supplies vary from other operators in their willingness to pay for water. Some crops, such as deciduous fruit, grapes, truck, and cotton, have greater abilities to pay for water than crops such as grain, hay, and miscellaneous field crops. Farm operators will normally only grow those crops which, as a minimum, return all the variable costs of production. Consequently, with high-cost water only the crops with higher payment capacities would be grown, but with

TABLE 5

ESTIMATED ANNUAL PAYMENT CAPACITIES AND WATER DEMAND  
SCHEDULE FOR DEVIL'S DEN WATER DISTRICT SERVICE AREA

Crop	: : Projected Crop Acreage: : in 1990 on Presently : : Developed Land : : (In acres)	: : Water Requirement : : (In acre-: (In acre- : feet) : feet) : : : :1952-56 Base Period: (In acre-feet)	: : Payment Capacity : : Per Acre-foot : : :1952-56 Base Period: (In acre-feet)	: : Cumulative : Water : Requirement : (In acre-feet)	
Miscellaneous truck	(400)	2.4	960	\$ 54.20	960
Deciduous fruit and nuts	500	2.9	1,450	47.20	2,410
Miscellaneous truck	700	2.4	1,680	47.10	4,090
Grapes	150	3.1	460	40.30	4,550
Cotton	1,800	3.8	6,840	33.40	11,390
Sugar beets	500	2.9	1,450	31.40	12,840
Grain	(1,200)	1.1	1,320	29.90	14,160
Miscellaneous field	1,470	2.1	3,090	24.80	17,250
Alfalfa, seed	750	3.2	2,400	12.80	19,650
Fallow	<u>600</u>				
Total	6,470		<u>19,650</u>		

Note: Amounts in parentheses indicate double cropped acreage  
grown in fall-winter-spring irrigation season.

low-cost water a larger amount of water would be purchased to irrigate crops with both high and low payment capacities.

The payment capacities of the various crops tentatively projected in the district's service area have been arrayed by magnitude in Table 5. Values in this table were used to plot the curve shown on Plate 3, "Water Cost-Demand Curve for Devil's Den Water District."

The weighted average unit cost of the present irrigation supply and the future supply of state water has been determined for the purpose of utilizing the water cost-demand curve. It has been assumed that ground water would cost \$12.00 per acre-foot, and the district would charge the rates for water from the State shown in columns 5 and 7 of Table 6 (bound at end of report). These rates for state water average about \$21.50 per acre-foot, for delivery of water to farm headgates. The weighted average unit cost for 6,400 acre-feet of ground water and 13,000 acre-feet from the Coastal Aqueduct is \$18.40 per acre-foot. At this water cost, the irrigation water cost-demand curve indicates there would be an economic demand for about 18,500 acre-feet of water annually.

The water cost-demand curve is based on a consideration of the payment capacity of each crop alone, with no allowance for averaging among crops. Theoretically, for a given cost of water, only those crops would be utilized which have payment capacities greater than the cost of water. It is believed, however, that within a farm unit, there will be some averaging; that is, the

owner would to some extent utilize the excess of payment capacity over cost of some crops to assist in the purchase of water for crops with payment capacities less than water costs. The growing of the latter crops would be desirable for crop rotation purposes. For this reason, it is believed that the economic demand for water in the district's service area will be approximately equal to the district's potential water requirement of 19,650 acre-feet annually. Since 6,400 acre-feet of the amount is expected to be supplied by ground water, the estimated economic demand for water from the State Water Project in the district's service area is 13,250 acre-feet annually.

#### Water Demand Buildup

The department's projected rate of water demand buildup in the district is based on the estimated future market demand for crops. The rate of demand buildup requested by the district and subsequently contracted for was approximately that proposed by the department. Therefore, in this report the district's request for annual entitlements has been used. The projected rate of demand buildup for annual entitlements to project water is presented in column 2 of Table 6. The amounts of surplus water assumed to be delivered on an irrigation demand schedule are shown in column 3 of Table 6.

## CHAPTER V. FINANCIAL FEASIBILITY

The previous chapter indicates there is an estimated economic demand for 13,250 acre-feet of state water in addition to the 6,400 acre-feet expected to be obtained from ground water to irrigate land in the Devil's Den Water District service area. As previously indicated the district has contracted for a maximum annual entitlement of 11,000 acre-feet. Presented in this chapter is an analysis which demonstrates the feasibility of a plan for the repayment by the district of the long-term debt which must be undertaken to purchase water under the contract and deliver the water to the users' headgates.

Although the cost of the water to the district will be relatively high, it is shown in Table 6, "Financial Analysis, Devil's Den Water District," that the district will not be unduly burdened by its debt incurred for purchase and distribution of water during the project repayment period.

The analysis indicates that the district can meet, on a year-to-year basis, the cost of project water and the cost of distribution facilities to get water to the land. It is believed that the information presented herein justifies the contract between the State and the district.

### Financial Analysis

The various factors entering into the financial analysis are discussed in the following paragraphs. The analysis is presented in Table 6 which appears at the end of the report.

## Water Toll

A water toll method of recovering water costs has been utilized in this analysis. Assumed district water tolls for annual entitlements and surplus water are shown in columns 5 and 7 of Table 6. During the period 1968 through 1972, a toll of \$21.00 per acre-foot has been assumed to recover all costs, including the cost of the turnout structure and measuring device and to provide excess revenue to insure against deficit spending in 1972, when surplus water is not expected to be available.

For the periods 1973 through 1982 and 1983 through 1990, tolls of \$20.00 and \$21.00 per acre-foot, respectively, have been assumed. These tolls will allow total revenues to equal total costs by the end of 1990. For the remainder of the repayment period the assumed tolls will balance costs on a year-to-year basis. It will be noted in the analysis that no revenue from the sale of surplus water is assumed after 1981. Some surplus water would probably be available at off-peak times after that year, but it is assumed it would be sold at or near cost. Costs and tolls would therefore remain in balance.

## Assessed Valuation and Bonded Indebtedness

The 1963-64 assessed valuation of the district was \$137,540 in the Kern County portion and \$95,730 in the Kings County portion. The bonded indebtedness assignable to the district's area was \$1,641 as of November 16, 1963. Thus the bonded indebtedness was 0.7 percent of the combined assessed valuation.



## Financial Analysis Table

Presented in Table 6 is a year-by-year summary of the assumed revenues from sale of water by the district; the costs which would be charged to the district by the State for annual entitlements and surplus water; the costs which would be incurred by the district for distribution of state water; the difference between revenues and costs or the net operating revenues; and the calculation of balance of funds remaining at the end of the year.

The capital cost for the turnout structure and measuring device from the Coastal Aqueduct must be paid prior to the start of construction. It is estimated that the cost of a turnout structure will be \$20,000, which will be due in 1966. In this analysis, it has been assumed that the district would pay this cost in a lump sum financed from a short-term loan.

During the early years of the project, substantial amounts of revenue in excess of cost are generated. These excess revenues accumulate in 1977 to a maximum of \$167,900, including interest at four percent. Thereafter, the year-end balance is reduced to zero by 1990 and remains so throughout the repayment period.

Although the net revenues are assumed to accumulate interest during the early years of the project, these funds could be used to make advance payments to the State. This would be equivalent to investment of the net revenues at four percent if the project interest rate, which is dependent upon the

interest rate on bonds sold by the State, averages four percent as was assumed in making the estimates of water cost.

The financial analysis contains many assumptions as to matters which are in the province of the Board of Directors of the Devil's Den Water District. It is believed, however, that the assumptions employed herein are sufficiently representative to demonstrate that not only is the suggested program financially feasible, but that it would remain so with reasonable variation in the assumptions.

An explanation of the column headings of the financial analysis table follows:

Explanation of Column Headings in Table 6

<u>Column Number</u>	<u>Explanation</u>
1	Years of the period of analysis commencing in year 1966, the year in which payment for the turnout structure is assumed to be made, and terminating in 2035, the assumed end of the 50-year repayment period following final project construction.
2	Delivery of annual entitlement water. The total demand and the rate of demand buildup are those negotiated by the department and the district, and which appear in Table A of the contract between the district and the State.
3	Annual delivery of surplus water on an irrigation demand schedule. Its use terminates after 1981, the estimated last year of availability of such surplus water.

Explanation of Column Headings in Table 6 (continued)

<u>Column Number</u>	<u>Explanation</u>
4	Total annual delivery to the district. (Sum of columns 2 and 3.)
5	Assumed tolls for entitlement water to all users in the district at farm headgate.
6	Total revenue from delivery of annual entitlements of water. (Product of columns 2 and 5.)
7	Assumed tolls for surplus water to all users in the district at farm headgate.
8	Total annual revenue from delivery of surplus water on an irrigation demand schedule. (Product of columns 3 and 7.)
9	Total annual revenue from delivery of both types of water. (Sum of columns 6 and 8.)
10	Annual repayment requirements for annual entitlements delivered at canalside to be paid to the State on a unit rate basis allowed under provisions of Article 45 of the Metropolitan Water District prototype contract.
11	Cost per acre-foot of delivering surplus water at canalside on an irrigation demand schedule.
12	Total annual cost of delivering surplus water at canalside on an irrigation demand schedule. (Product of columns 3 and 11.)
13	Total annual cost of delivering both types of water at canalside. (Sum of columns 10 and 12.)

Explanation of Column Headings in Table 6 (continued)

<u>Column Number</u>	<u>Explanation</u>
14	Total annual local distribution costs based on operation, maintenance, and replacement costs of \$1.33 per acre-foot for the existing distribution system.
15	Total annual cost of delivering both types of water to the farm headgate. (Sum of columns 13 and 14.)
16	Difference between cost of delivering both types of water to the farm headgate and estimated revenue received by the district from the sale thereof. (Column 9 less column 15.)
17	Balance of available funds from previous year plus net operating revenue collected in current year. (Sum of column 19 of previous year and column 16 of current year.)
18	Interest earning on balance of district funds. (Product of .04 and column 17.)
19	Balance of funds available to district at end of each year. (Sum of columns 17 and 18.)

## CHAPTER VI. SUMMARY AND CONCLUSIONS

The pertinent information presented in this report is summarized and conclusions are presented in the following sections.

### Summary

1. The Devil's Den Water District, comprising 8,693 acres in southwest Kings and northwest Kern Counties, was formed in 1962 for the express purpose of obtaining a supplemental irrigation water supply from the State Water Project. Plans of the district are to serve the area east of the west line of Section 1, Township 25 South, Range 18 East. This service area comprises 7,160 acres.
2. The district may contract with the State for a water supply, construct and operate distribution facilities to deliver said supply, and obtain funds by water charges and by ad valorem assessments of land.
3. The present economy of the district is closely associated with irrigated agriculture. Presently about 2,900 acres are irrigated. It is expected that the purchase of water from the State will enhance the economy and that it will continue to be based on irrigated agriculture.
4. The California Water Commission, as of December 1963, allocated 1,547,000 acre-feet of water from the State Water Project to the San Joaquin Valley, including 72,000 acre-feet reserved for the valley from other allocations if needed. At the time final negotiations of a water supply contract between the State and the district were in progress in December 1963, only 1,000,000 acre-feet of this total had been contracted,

and other contracts for 206,500 acre-feet were under negotiation. Thus ample water for annual entitlements was available for contracting with the district.

5. There is a need for supplemental water supply in the district's service area to eliminate the present overdraft on ground water and to provide an adequate water supply for enhancement of the agricultural economy. It is believed there will be no significant need for water for urban purposes in the district. It is estimated that the potential requirement for water in the district would be 19,650 acre-feet if only the physical factors of water demand are considered.

6. The present source of water supply for irrigation of land in the district is ground water pumped from local wells with extractions unquestionably exceeding the safe yield. It is estimated that when water is received from the Coastal Aqueduct under conditions of full development, 6,400 acre-feet of water per year could be safely pumped from the ground water supply, utilizing both local runoff and reuse of percolate from the imported supply.

7. The potential requirement for imported water in the district's service area is equal to the difference between the total potential requirement and the local supply under full development, approximately 13,250 acre-feet.

8. Water from the Coastal Aqueduct can be provided to the district at an estimated equivalent unit rate for the annual entitlements of \$21.08 per acre-foot at canalside. The

unit rate for surplus water used for agricultural purposes in the district's service area is estimated to range from \$7 to \$8 per acre-foot. The equivalent unit rate for delivery of combined entitlement and surplus water is about \$19.60 per acre-foot over the repayment period.

9. Existing distribution facilities in the district are sufficient to distribute the local and imported water supply. These facilities are now owned and operated by the organization farming the land in the district, but in this report it is assumed that the district will distribute the imported water, incur all operation and maintenance costs, and collect therefor from the water users. It is estimated these costs will be \$1.33 per acre-foot during the project repayment period. In addition the district must pay about \$20,000 for construction of a turnout structure.

10. Consideration of the payment capacity of crops and the cost for purchase and distribution of water indicates that the economic demand in the district in 1990 will approximately equal the district's potential water requirement of 19,650 acre-feet per year. The economic demand could be supplied by utilizing 6,400 acre-feet from ground water and 13,250 acre-feet from the State Water Project by contract with the State. The district contracted on December 20, 1963, for a water supply of 11,000 acre-feet annually from the State Water Project.

11. The assessed valuation of the district is \$233,270 based on the 1963-64 assessment. The bonded indebtedness assignable to the district was \$1,641 as of November 15, 1963. The bonded indebtedness is thus 0.7 percent of the assessed valuation.

12. The district will not be unduly burdened by the debt incurred for purchase and distribution of water under the state contract during the project repayment period.

#### Conclusions

1. The State of California has the necessary water supply and the authority to enter into the contract with the Devil's Den Water District which was signed December 20, 1963, for the service of a maximum annual entitlement of 11,000 acre-feet of water. The contract includes an option to increase the amount of the contract by the district's share of the project yield uncontracted on December 31, 1963.

2. The contractual cost to the district and the cost for distribution of the water can be met with agricultural water tolls which would not exceed the ability of the users to pay for water.

3. The Devil's Den Water District has the authority, the necessity, and the financial capability to enter into a contract with the State of California for the service of a maximum annual entitlement of 11,000 acre-feet of water from the State Water Project.







al :	:Previous Year:			:
t :	Net	: Balance Plus:	Interest:	Balance
arm:	Operating:	Net Operating:	at	: at End
ate:	Revenue :	Revenue :	4%	: of Year

=15	9-15=16	17	18	17+18=19
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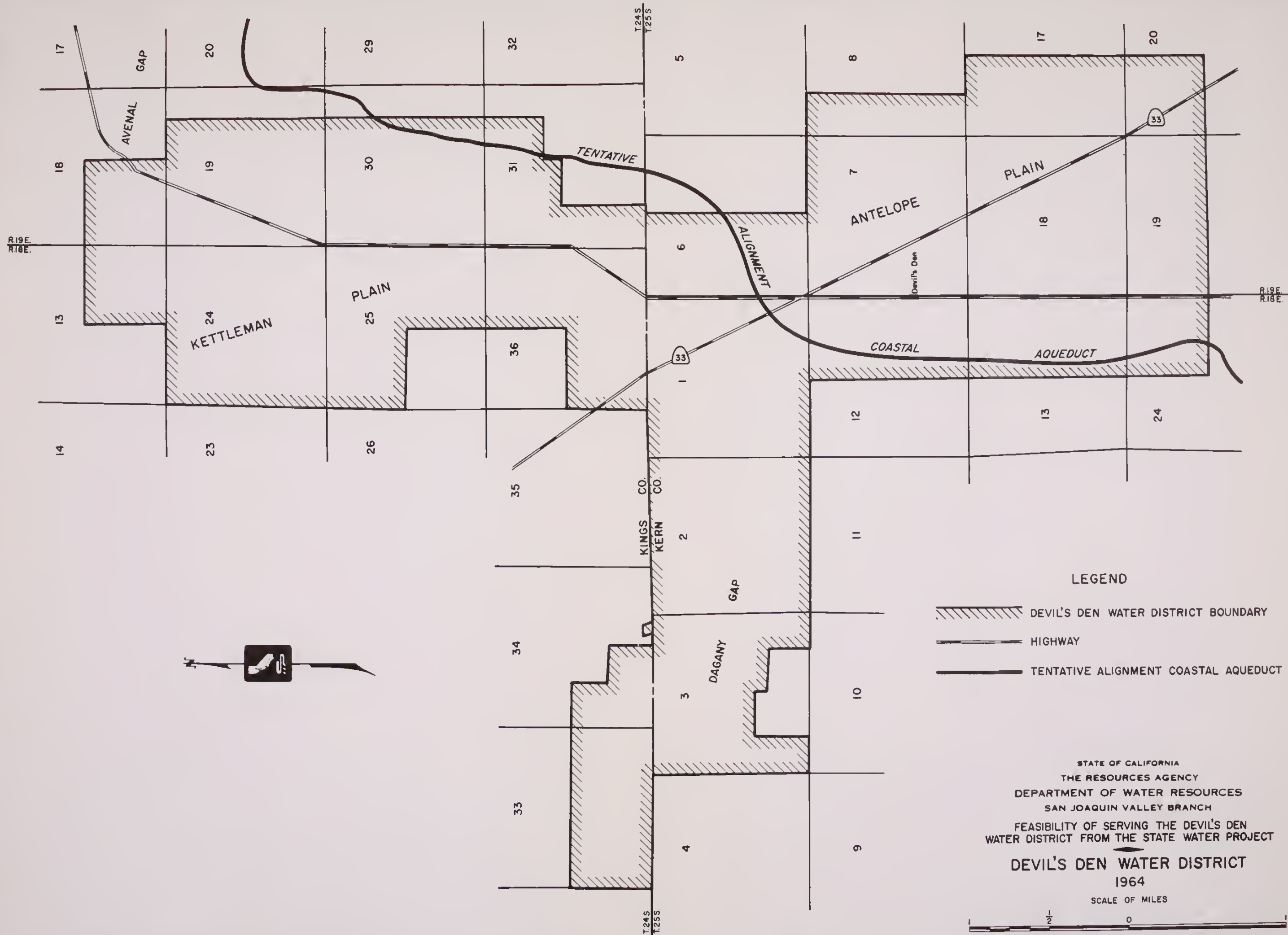
		\$-20,000*		
00	\$ -1,100	-1,100	\$ -800	\$-21,900
00	14,700	-7,200	-300	-7,500
00	10,700	3,200	100	3,300
00	7,500	10,800	400	11,200
00	4,600	15,800	600	16,400
00	-12,500	3,900	200	4,100
00	54,100	58,200	2,300	60,500
00	41,100	101,600	4,100	105,700
00	25,900	131,600	5,300	136,900
00	14,300	151,200	6,000	157,200
00	4,200	161,400	6,500	167,900
00	-18,300	149,600	6,000	155,600
00	-17,200	138,400	5,500	143,900
00	-8,900	135,000	5,400	140,400
00	-7,500	132,900	5,300	138,200
00	-32,200	106,000	4,200	110,200
00	-17,300	92,900	3,700	96,600
00	-21,300	75,300	3,000	78,300
00	-20,700	57,600	2,300	59,900
00	-15,800	44,100	1,800	45,900
00	-14,500	31,400	1,300	32,700
00	-13,600	19,100	800	19,900
00	-12,600	7,300	300	7,600
00	-7,600	0	0	0
00	0	0	0	0

TABLE 6  
FINANCIAL ANALYSIS  
DEVIL'S DEN WATER DISTRICT

Year	: Annual Water Deliveries :			Annual Revenues					Annual Costs at Canalside				: Total :		:Previous Year:			
	: (In acre-feet) :			: Entitlement :		: Surplus :			:Entitlement:		: Surplus :		: Local : Cost :		: Net :		: Balance Plus:Interest: Balance	
	: Per :			: Per :		: Total :			: Per :		: Total :		: Distribution: at Farm:Operating:		:Net Operating: at :		: at End	
	:Entitlement:	:Surplus:	:Total :	:Acre-foot:	: Total :	:Acre-foot:	: Total :	: Total :	:Acre-foot:	: Total :	: Costs :	:Headgate:	: Revenue :	: Revenue :	: 4% :	: of Year		
1	2	3	2+3=4	5	2x5=6	7	3x7=8	6+8=9	10	11	3x11=12	13	14	13+14=15	9-15=16	17	18	17+18=19
1966																\$-20,000*		
67									\$ 1,100			\$ 1,100		\$ 1,100	\$ -1,100		\$ -800	\$ -21,900
68		2,000	2,000	4,000	\$21.00	\$ 42,000	\$21.00	\$ 42,000	\$ 84,000	44,700	\$9.65	\$19,300	64,000	\$ 5,300	69,300	14,700	-300	-7,500
69		3,000	1,400	4,400	21.00	63,000	21.00	29,400	92,400	65,000	7.71	10,800	75,800	5,900	81,700	10,700	100	3,300
1970		4,000	1,400	5,400	21.00	84,000	21.00	29,400	113,400	86,600	8.65	12,100	98,700	7,200	105,900	7,500	400	11,200
71		5,000	1,200	6,200	21.00	105,000	21.00	25,200	130,200	108,200	7.69	9,200	117,400	8,200	125,600	4,600	600	16,400
72		6,000	0	6,000	21.00	126,000	21.00	0	126,000	130,500	0	0	130,500	8,000	138,500	-12,500	200	4,100
73		7,000	6,000	13,000	20.00	140,000	20.00	120,000	260,000	148,200	6.73	40,400	188,600	17,300	205,900	54,100	2,300	60,500
74		8,000	5,000	13,000	20.00	160,000	20.00	100,000	260,000	166,600	7.00	35,000	201,600	17,300	218,900	41,100	4,100	105,700
1975		9,000	4,000	13,000	20.00	180,000	20.00	80,000	260,000	187,900	7.23	28,900	216,800	17,300	234,100	25,900	5,300	136,900
76		10,000	3,000	13,000	20.00	200,000	20.00	60,000	260,000	207,100	7.11	21,300	228,400	17,300	245,700	14,300	6,000	157,200
77		11,000	2,000	13,000	20.00	220,000	20.00	40,000	260,000	224,000	7.27	14,500	238,500	17,300	255,800	4,200	6,500	167,900
78		11,000	2,000	13,000	20.00	220,000	20.00	40,000	260,000	246,100	7.43	14,900	261,000	17,300	278,300	-18,300	6,000	155,600
79		11,000	2,000	13,000	20.00	220,000	20.00	40,000	260,000	245,200	7.34	14,700	259,900	17,300	277,200	-17,200	5,500	143,900
1980		11,000	2,000	13,000	20.00	220,000	20.00	40,000	260,000	239,500	6.05	12,100	251,600	17,300	268,900	-8,900	5,400	140,400
81		11,000	2,000	13,000	20.00	220,000	20.00	40,000	260,000	238,000	6.09	12,200	250,200	17,300	267,500	-7,500	5,300	138,200
82		11,000		11,000	20.00	220,000			220,000	237,600			237,600	14,600	252,200	-32,200	4,200	110,200
83		11,000		11,000	21.00	231,000			231,000	233,700			233,700	14,600	248,300	-17,300	3,700	96,600
84		11,000		11,000	21.00	231,000			231,000	237,700			237,700	14,600	252,300	-21,300	3,000	78,300
1985		11,000		11,000	21.00	231,000			231,000	237,100			237,100	14,600	251,700	-20,700	2,300	59,900
86		11,000		11,000	21.00	231,000			231,000	232,200			232,200	14,600	246,800	-15,800	1,800	45,900
87		11,000		11,000	21.00	231,000			231,000	230,900			230,900	14,600	245,500	-14,500	1,300	32,700
88		11,000		11,000	21.00	231,000			231,000	230,000			230,000	14,600	244,600	-13,600	800	19,900
89		11,000		11,000	21.00	231,000			231,000	229,000			229,000	14,600	243,600	-12,600	300	7,600
1990		11,000		11,000	21.40	235,400			235,400	228,400			228,400	14,600	243,000	-7,600	0	0
1991-2035		11,000		11,000	22.03	242,300			242,300	227,700			227,700	14,600	242,300	0	0	0

\*Lump sum for turnout structure.





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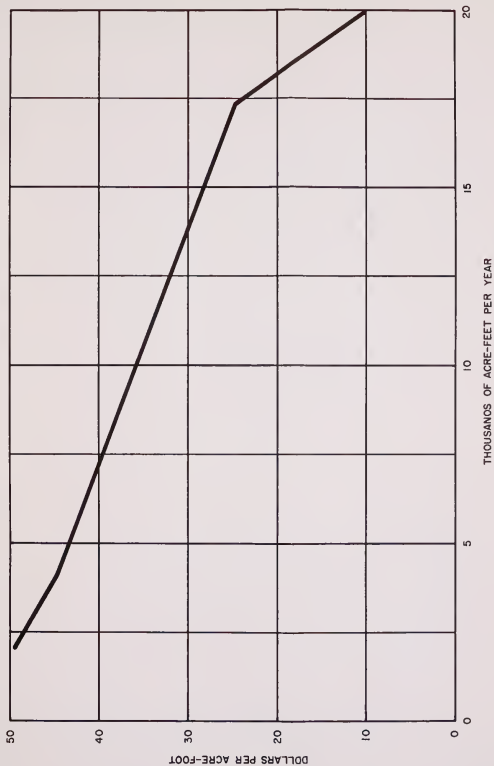
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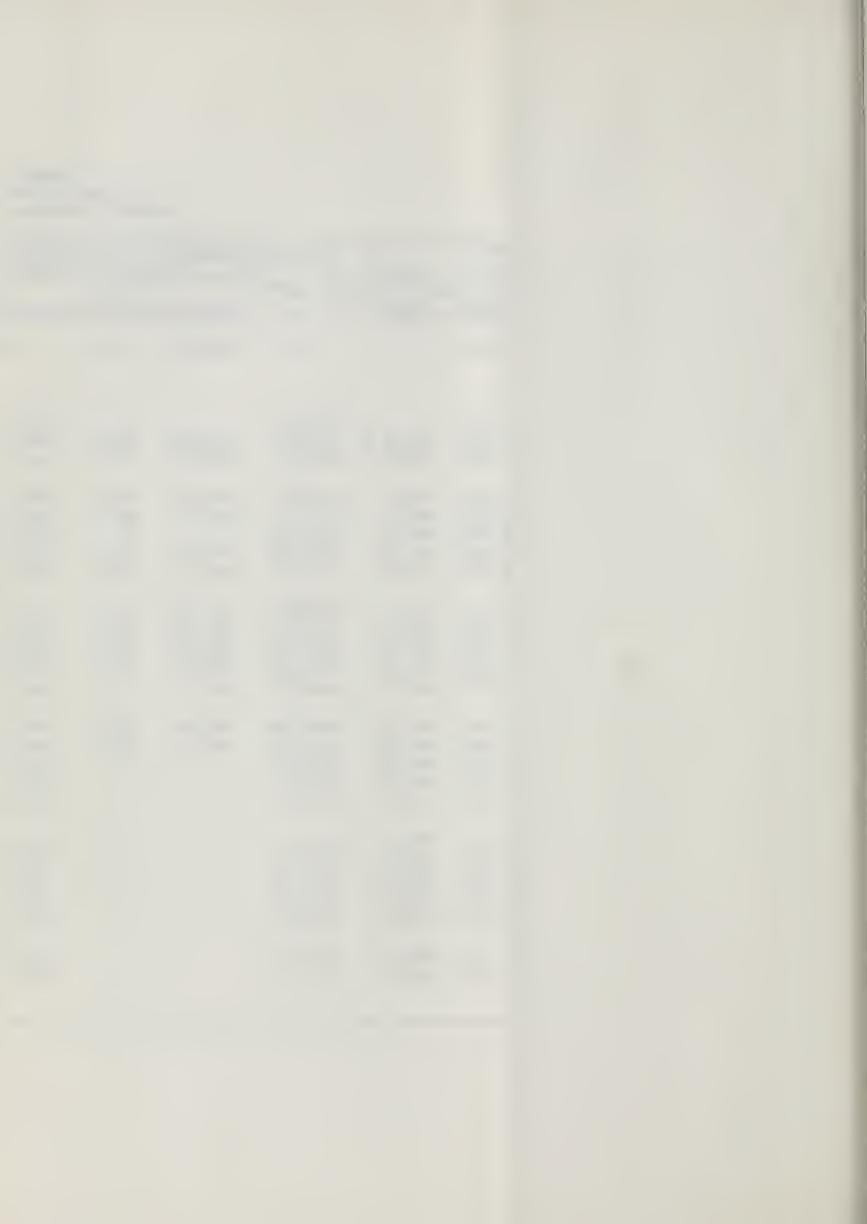
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SCALE OF MILES





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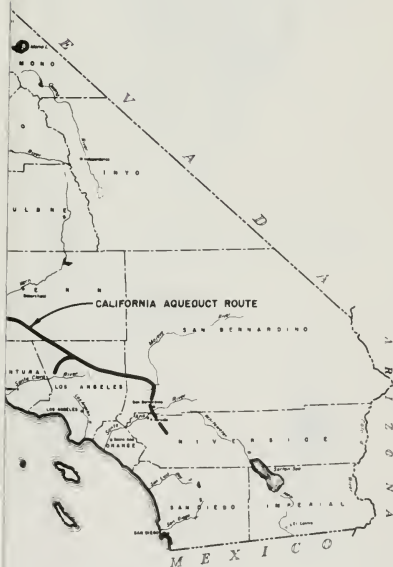


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